REMARKS/ARGUMENTS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-67 are pending in this application.

Objections to the Claims:

Claims 1, 7, 27, 46, 47 and 67 were objected to because the phrase "successive cycles of working chamber volume" was allegedly not clear. Claims 38 and 59 were objected to because the phrase "until almost the end of a stroke" was allegedly not clear. Without acquiescing to the propriety of these objections, these claims have been amended in accordance with the Examiner's helpful suggestions. Applicant thus requests that the objections to the claims be withdrawn.

Rejections under 35 U.S.C. §112:

Claims 2, 5, 6, 8, 12, 13, 17, 18, 20, 21, 24, 26, 31, 32, 36, 37, 39, 40, 43, 45, 48, 52, 53, 57, 58, 60, 61 and 66 were rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Without acquiescing to the propriety of these rejections, many of these claims have been amended in accordance with the Examiner's helpful suggestions.

Page 3 of the Office Action alleges "In Re Claim 18, the range: 'below full output but above a fixed or variable threshold' and 'falls below a fixed or variable threshold' is indefinite." Applicant disagrees with this allegation. Claim 18 clearly recites two mutually exclusive conditions: (i) when flow demand is below full flow output but above a fixed or variable threshold, and (ii) when flow demand falls below a fixed or variable threshold. Since conditions (i) and (ii) describe different conditions with respect to flow demand, these conditions are not indefinite. In particular, claim 18 clearly recites that when condition (i) is met, idling modes are

interspersed with full modes. Claim 18 further clearly recites that when condition (ii) is met, a combination of some or all of idling modes, part modes and full modes is employed. Applicant therefore respectfully submits that claim 18 is not indefinite under 35 U.S.C. §112, second paragraph.

Section 7 (page 3) of the Office Action alleges "In addition, for the dependent claims that lack antecedent basis, it is assumed that the limitations of Claim 3 are incorporated into independent Claim 1." Applicant disagrees with this allegation. First, Applicant submits that the dependent claims have a proper antecedent basis, and thus the alleged assumption that the limitations of claim 3 are incorporated into independent claim 1 is unjustified. Moreover, machines could be provided which do not have each of the five modes required by claim 3. They may only pump or only motor. In any event, the limitations of claim 3 should not be interpreted as being incorporated into independent claim 1.

Section 5 (page 3) of the Office Action alleges that the word "small" in the phrase "small fraction" is indefinite. Applicant respectfully disagrees. As stated in MPEP section 2173.05(b), "The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. §112, second paragraph." Applicant submits that one of ordinary skill in the art would understand the meaning of "small" in light of the specification. For example, the amount of small in "a *small* fraction in advance of the top dead centre position" as claimed and "a *small* fraction after the top dead centre position" as claimed is clearly understandable from Figs. 2-3 of the present application (see, e.g., the shaded areas at the respective tops of Figs. 2-3).

Accordingly, Applicant requests that the rejections under 35 U.S.C. §112, second paragraph, be withdrawn.

Rejections under 35 U.S.C. §103:

Claims 1 and 2 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over the three-way combination of Sturman (U.S. '207) in view of Nippert (U.S. '545) and Salter et al. (U.S. '738, hereinafter "Salter"). Applicant traverses this rejection.

In order to establish a *prima facie* case of obviousness, all of the claim limitations must be taught or suggested by the prior art. The three-way combination of Sturman in view of Nippert and Salter fails to teach or suggest all of the claim limitations. For example, the combination fails to teach or suggest "wherein the electronic sequencing controller has a configuration to operate the valves of each chamber in one of an idling mode, a partial mode in which only part of the usable volume of the chamber is used, and a full mode in which all of the usable volume of the chamber is used, and the electronic sequencing controller has a configuration to select the mode of each chamber on successive cycles of changing working chamber volume so as to vary the time averaged effective flow rate of fluid through the machine," as required by independent claim 1 (and claim 2 which depends therefrom).

Independent Claim 1

The Office Action (section 10; page 5) apparently alleges that Sturman discloses "select[ing] the mode of each chamber on *successive cycles of changing working chamber volume* so as to vary the time averaged effective flow rate of fluid through the machine (emphasis added)" as required by claim 1. Applicant disagrees with this allegation. For example, Sturman does not disclose a fluid-working machine in which the controller is for operating valves in timed relationship with the changing volume of each chamber. Sturman in no way teaches or suggests operating the valves in this way. Notably, at col. 3, line 12, Sturman incorporates by reference U.S. Patent No. 5,640,987 which discloses a balancing valve which is

slow to operate ("increasing response time" col. 3, lines 64-65; col. 5 line 28) and which is entirely unsuitable for operating valves in timed relationship with the changing volume of each chamber. *Such a valve would be especially inappropriate for partial modes* where fast moving valves would be required. Thus, Sturman teaches a machine designed for occasional change in the output of the machine as a whole.

In more detail, the Office Action (page 5) apparently alleges that col. 3, lines 14-15 and col. 3, lines 29-30 of Sturman discloses "select[ing] the mode of each chamber on successive cycles of changing working chamber volume so as to vary the time averaged effective flow rate of fluid through the machine" as claimed. Again, Applicant disagrees with this allegation. Sturman discloses that the pump *as a whole* may have different modes, for example as set out in Figure 3. Sturman does not refer to the individual chambers as having different modes. It is true that in different modes of the pump, the displacement of individual chambers may be different. However, Sturman fails to disclose or suggest selecting the mode of each chamber *on successive cycles of changing working chamber volume*. Thus, the device of Sturman has only eight operating modes whereas a device according to the invention of claim 1, which selects the mode of each chamber on successive cycle of changing working chamber volume, can have an effectively infinite range of possible outputs over time.

The Office Action (page 5) alleges that Sturman discloses that the selection (of the operating mode of the pump) is made during operation by referring to col. 3, line 33 which states: "By varying the by-pass states of the valve 46, the controller 48 can change the fluid output of the pump 10 without changing the speed of the shaft 32. When incorporated into a system such as an internal combustion engine, the fluid output of the pump 10 can be varied independently from the speed of the engine." This portion of Sturman communicates little

beyond the fact that different fluid displacements can be obtained for the same shaft speed, as would be the case for any variable displacement pump. There is no suggestion of rapid control responsive to an input signal.

There is also no suggestion of valves being operated in timed relationship with the changing volume of each chamber. The Office Action (page 5) alleges that "it would be obvious to one of ordinary skill not to interrupt a cycle for a chamber in FULL mode until it has completely displaced its volume (cycle complete) otherwise there could exist a flowrate that was never intended." However, Applicant submits that there is no reason for one skilled in the art to come to this conclusion and this would still not constitute selecting the mode of a chamber on successive cycles of changing working chamber volume. Indeed, it is not possible to operate the valves of Sturman in timed relationship with the changing volume of each working chamber. Sturman does not disclose any apparatus to measure the phase of the cycles of working chamber volume which would be required to synchronize any activity with cycles of working chamber volume. Sturman discloses a slow acting mechanism. Sturman has not envisaged synchronizing valve timing with cycles of working chamber volume and does not teach the use of such timing.

Moreover, it would not have been obvious to one having ordinary skill in the art at the time of the invention to modify any of the pump sub assemblies of Sturman (in the light of Nippert) so that the working chambers only pump a portion of their total volume and bypass the remaining valve by switching valve 46 part way though the exhaust stroke so that member 44 is exposed to the high pressure port and opens the inlet check valve 40. One skilled in the art would not be motivated in this way, *nor is it in fact possible to modify Sturman in this way*.

In more detail, there is no teaching or suggestion in Nippert that a decision should be made as to which mode should be selected on each of "successive cycles of changing working chamber volume" as claimed. Instead, Applicant submits that, given the possibility of partial strokes, one of ordinary skill in the art reading Nippert would use continuous partial cycles to provide the desired flow rate of fluid. If the required demand was 30% of the maximum output, for example, Applicant submits that one of ordinary skill in the art reading Nippert would output 30% of the maximum volume of each chamber during each cycle of working chamber volume.

If one of ordinary skill considered using partial strokes in the machine of Sturman (i.e., in light of Nippert), that person would do so as Nippert teaches and thus set each chamber to output a partial stoke on each cycle to meet the demand. Thus, to provide a demand of 30% of the maximum output, each chamber could be set to output 30% of its maximum volume during each cycle.

The Office Action (sections 14 and 70) refers to the title of Sturman which states "Digital Pump." This title *teaches away* from considering the use of partial strokes in the machine of Sturman. Sturman teaches that in different modes of the pump as whole different proportions of the overall pump output can be obtained. This is illustrated in Figure 3 where the output is quantized into a mere eight steps. One of ordinary skill would see the word "digital" in the title as either referring to the possibility of the output of each chamber being one of two values (binary [0 or 1]) or referring to the possibility that the output is quantized by the number of chambers being enabled. "Digital" does not in any way suggest a continuous "analog" range of output as could be obtained using partial strokes.

As noted above, Sturman cannot be modified to provide partial modes. Sturman does not have any kind of shaft position sensor and has no capability to measure, let alone synchronize valve timing, in relation to cycles of changing working chamber volume. Importantly, Sturman discloses an arrangement in which valve 40 could be selectively held open by valve 46 via piston 44 and a connecting channel (not numbered). *The balancing valves disclosed by reference are too slow for partial modes*, as is the requirement for control valve 46, piston 44 and the connecting channel to be employed which would require a significant amount of time to move or pressurize respectively. Indeed, any valve actuated by spool-valve controlled hydraulic actuation would have significant latency as this is inherently a slow mechanism.

The Office Action (section 14) alleges that a partial pumping mode could be obtained by opening the valve to the low pressure manifold part way through a pumping stroke to bypass the remaining fluid, "by switching valve 46 part way through the exhaust stroke so that member 44 is exposed to the high pressure port and opens the inlet check valve 40". In Sturman's machine, this would require the ball which forms valve 40 to be actively moved away from its seat by piston 44 against a pressure in the chamber. Aside from the lack of means to synchronize this action with cycles of working chamber volume, this would be entirely impractical in a machine such as Sturman intended for connection to an internal combustion engine (i.e., running at over 3000 RPM) and therefore subject to substantial pressures in the working chamber and having to pressurize and depressurize the channel between control valves 46 and the valves 44 the each cycle of working chamber volume. Furthermore, Sturman does not disclose that the piston 44 is even able to open the valve 40 against pressure in the chamber. Such an operation would require a larger product of pressure and area opening the piston compared to closing the valve (i.e. piston 44 area x actuation pressure > valve 40 area x chamber pressure), which is not described nor

suggested by the drawings (or any other portion of Sturman). The drawings indicate that the actuation pressure is derived via control valve 46 from the outlet pressure, itself derived from the chamber pressure via outlet check valve 42, and thus the actuation pressure will always be lower than the chamber pressure. The piston 44 area is drawn smaller than the valve 40 seating area, indicating that it would not be possible to open the valve 40 part way through a stroke to bypass the remaining volume to obtain the Office Action's partial pumping stroke.

The Office Action (section 73) refers to the Figure 1 of Nippert as having pressure accumulators. However, these pressure accumulators are not provided between the fluid working machine 12 and load 18, as would be required to facilitate changing mode of a cylinder from one cycle to the next. As is clear from Figure 4, these accumulators are provided to supply fluid to and receive fluid from relief valves 80 and 82 on start up and in the event of overpressure. They are not in the closed loop 30, 32 between a pump and motor. Thus, it is not possible to change the mode of a chamber in the machine disclosed in Nippert from one cycle to the next as the mode of another chamber would need to be changed at the same time.

Dependent Claim 2

The Office Action (section 15) alleges that claim 2 is obvious as determining the precise fraction of usable volume in the partial mode constitutes discovering an optimum value involving only routine skill in the art. However, the benefits of using only a small fraction interspersed with idle and full strokes (compared to using any fraction without interspersed idle and full strokes) could be not obtained by optimization. Prior to the invention of claim 2, it would not have been practical for one of ordinary skill to make a machine (with the features of base claim 1) which was operable to dispense any volume of working fluid between 0% and 100% of the maximum stroke volume of a working chamber. The pressure within the working

chamber is too high in practice for the state of the valve to be changed in an energy efficient and rapid enough way using valves known at the time of the invention. Either the valves need to be opened or closed against a very high pressure differential or the valves need to be opened or closed following a pressure differential which is so high that they would be damaged by impact following opening or closing. The use of only a small fraction of working chamber volume in claim 2 enables a practical device to be made with high operating life and low power consumption.

Accordingly, Applicant respectfully requests that the above-noted rejection of claims 1-2 under 35 U.S.C. §103 be withdrawn.

Claims 3-67 have been rejected under 35 U.S.C. §103 as allegedly being unpatentable over Sturman in view of Salter, and further in view of Nippert. Applicant traverses this rejection. The comments made above for claim 1 with respect to the three-way combination of Sturman, Salter and Nippert apply equally to each of its dependent claims (some of which are discussed in more detail below).

Dependent Claim 3

In addition to the points set out above with respect to base claim 1, it is notable that Sturman does not disclose a motor. Sturman's device could not be adapted to control a motoring cycle as motoring cannot be regulated by simply holding the low pressure valve open in specific circumstances. For example, the original specification discloses active control of the valve linking the high pressure manifold to the working chamber to control a motoring cycle.

The Office Action refers to Salter as disclosing a partial motoring mode. However, this is not a reference to a motoring mode which is selectable by operating valves in timed relationship with the changing volume of each chamber, but is instead a reference to an

uncontrolled failure mode. Please see more detailed comments on Salter with respect to independent claim 25 below.

Dependent Claim 5

Nippert does not teach or suggest any reason to close the low pressure valve and open the high pressure valve a small fraction in advance of the top dead centre position. Nippert does not teach or suggest changing the mode of each cylinder on successive cycles of changing working chamber volume and Nippert does not in any way suggest why it would be advantageous to select between modes including a partial mode having such a small displacement volume. However, by considering the possibility of interspersing idle strokes with strokes in which the low pressure valve is closed and the high pressure valve opened a small fraction in advance of the top dead center position, the invention of claim 5 inventively provides a machine with improved performance, reliability and energy efficiency at relatively low proportions of maximum displacement. This could not be expected from the cited prior art.

Dependent Claim 6

Sturman does not disclose or suggest any kind of motoring stroke, nor is the machine as disclosed even capable of any kind of motoring stroke. Nippert does not disclose a partial motoring stroke, let alone any partial motoring stroke having the feature of claim 6. A *pumping* cycle may be disclosed, but no part volume *motoring* cycle is disclosed. In short, Nippert does not disclose partial motoring and could not be adapted to provide partial motoring.

The Office Action (section 29) alleges that Nippert could be adapted to use a first portion of the received high pressure fluid to create rotary motion, bypass an intermediate portion, and use the remaining portion of the volume to create motion. This is not possible. Fluid cannot be bypassed during motoring. If delivered to the low pressure manifold it would exit the working

chamber explosively, creating noise and happening at an uncontrollable speed. It could not be delivered back to the high pressure manifold by an expanding working chamber ("the low pressure valve would need to open to allow the fluid to be pumped"), and certainly doing so while the low pressure valve is open is nonsensical. No strategy for obtaining partial strokes except by bypassing is taught by Nippert, and bypassing is simply impossible during partial motoring.

The Office Action (section 75) alleges that the partial motoring mode is compatible with the motoring cycle discussed in Nippert. Firstly, Applicant submits that Nippert teaches only that partial modes can be obtained by bypassing fluid between the working chamber and the low pressure side, and only describes how this is used to achieve a partial *pumping* mode. It is not possible to bypass fluid during a *motoring* stroke, as discussed in relation to claim 6 – the Office Action's own description of a partial motoring stroke (section 75) does not involve a flow of fluid from the low pressure side and is therefore not based on the state of the art as taught by Nippert. See also page 23 of Applicant's of previous response filed January 4, 2010.

The Office Action appears to continue the unsupported allegation that Nippert discloses a partial *motoring* mode (section 75: "The partial motoring mode is therefore NOT incompatible with the motoring cycle discussed in Nippert."). In each of the three passages referring to varying displacement "by controlling the volume that each piston can produce" (note, no mention of "absorb"), Nippert is explicit in describing pumping (col. 8, lines 46, 48, 49;) but makes no mention whatsoever of motoring. This is not surprising because it is not possible: a partial motoring stroke by bypassing fluid to the low pressure side is not possible with Nippert's machine, and therefore the variable stroke cycle described therein is not applicable to motoring.

The Office Action has described a way in which the machine of Nippert might achieve a partial motoring cycle. However, the hydraulically locked piston mode proposed by the Office Action (section 75) to achieve this end is described by Nippert as being employed "to totally stop the flow of fluid into and out of the selected piston... in either direction of fluid flow" (col. 8, line 53). In each of three cases in the disclosure describing the locking of pistons, they are to be locked at TDC. There is simply no basis in Nippert for the locked pistons being used to produce partial strokes (or full strokes for that matter) either in pumping or motoring modes, as these would require the pistons to be locked at other than TDC. Thus, one skilled in the art would not be able to use the locking mechanism to provide partial pumping strokes, let alone partial motoring strokes.

Independent Claim 7

The Office Action is incorrect to state that the combination of Sturman, Nippert and Salter as applied to claim 3 discloses all claimed limitations of claim 7. This combination fails to disclose or suggest a device which would, in normal and usual operation, operate valves to select between an idling mode, a partial mode and a full mode, wherein the mode is selected on successive cycles of changing working chamber volume, nor could a device which operates in this way be obtained by combining features of these documents.

Sturman does not refer to partial strokes nor to selection of the mode of an individual chamber on successive cycles of changing working chamber volume. Nippert does not disclose the selection of the mode of an individual chamber on successive cycles of changing working chamber volume. Salter does not disclosed a partial mode of each working chamber (the reasoning for this latter point is set out in relation to claim 25 below).

Dependent Claim 8

See comments for claims 2 and 5 above.

Dependent Claim 11

See comments above in relation to base claim 7. Furthermore, Nippert has not disclosed or taught any method of achieving a partial motoring mode.

Dependent Claim 12

See comments for claims 2 and 6 above.

Dependent Claim 13

See comments for claims 2 and 5 above.

Dependent Claim 14

See comments for claim 3 above.

Dependent Claim 15

As discussed above in relation to claim 1, there is no teaching of or suggestion in the cited art that partial stroke and idling strokes could be employed in combination to meet a demand signal rather than, for example, consistent partial strokes, or combinations of idle and full strokes.

Dependent Claims 17, 18

See comments for claim 25 below.

Dependent Claim 19

See comments for claims 2, 5 and 6 above.

Dependent Claims 20 and 21

Claims 20 and 21 provide features on the volume fraction displaced in the partial mode. Without these features, partial strokes are not possible at the pressures and speeds found in practical machines. The fact that Nippert has disclosed a device which is energy costly due to the difficulty of opening and closing valves against pressure differences during the middle region of a stroke is evidence that the features of claims 20 and 21 are not obvious to the person of ordinary skill.

Dependent Claim 26

See the comments for claim 5 above.

Independent Claims 27 and 67

Claims 27 and 67 require, inter alia, "select the mode of each chamber on successive cycles of changing working chamber volume so as to vary the time averaged effective flow rate of fluid through the machine." The cited combination of art fails to teach or suggest this claimed limitation for reasons discussed above with respect to similar limitations of claim 1. Also, it would not have been obvious to intersperse idle and partial motoring cycles. Instead one of ordinary skill in the art would use only partial modes on each cycle -- as discussed above.

Dependent Claims 28 and 30

For claim 30, see the comments for claim 2 below -- partial motoring as claimed is not in itself either known or obvious.

Dependent Claim 37

There is no suggestion in the prior art that there would be any practical reason to combine idle, part and full modes in successive cycles of changing working chamber volume. Given the possibility of partial modes (Nippert), one skilled in the art would use only partial modes, on

each cycle of working chamber volume. Given interspersed full and idle strokes (Salter), one skilled in the art would use only full and idle strokes. That person not mix partial mode cycles with other modes because there is no obvious need. Still further, it would not be obvious to combine all three types of mode in a sequence at any level of demand.

Dependent Claims 38, 45

See the comments forclaim 5 above. Whether motoring or pumping, the cited art neither teaches nor suggests delaying valve actuations until almost the end of a stroke. This inventive concept enables partial modes to be implemented in machines having substantial working chamber pressures, high rotation speeds, and direct acting (i.e. fast) valves.

Independent Claim 46, 47

As discussed above, the cited art does not teach operating valves in an operation sequence composed of partial strokes in which only part of the usable volume is used and idling modes with the fraction of the two modes reflecting a demand level. One of ordinary skill, provided with a partial mode, would use a partial stroke on each cycle.

Dependent Claim 51

As discussed above, the combination of Sturman, Nippert and Salter fails to teach or suggest suggested partial stroke motoring cycles controlled by valves nor provided an enabling disclosure as to how one might be carried out.

Dependent Claims 52, 53

See the comments for claims 5 and 6 above.

Dependent Claim 54

See the comments for claim 3 above.

Dependent Claims 55, 56, 59, 66

See the comments for claim 27 above.

Dependent Claims 57,58

See the comments for claim 37 above.

Independent Claim 65

See the comments for claim 25 below.

Accordingly, Applicant respectfully requests that the above-noted rejection of claims 3-67 under 35 U.S.C. §103 be withdrawn.

Claims 25 and 44 have been rejected under 35 U.S.C. §103 as allegedly being unpatentable over Nippert in view of Salter and further in view of Mestieri (U.S. '816). Applicant traverses this rejection.

Claim 25 requires, *inter alia*, "operating the valves of a said working chamber in a *partial motoring* mode in which only part of the usable volume of the chamber is used (emphasis added). Claim 44 requires, *inter alia*, "a controller having a configuration to operate the valves of at least one of said working chambers in a *partial motoring* mode in which only part of the usable volume of the at least one working chamber is used (emphasis added)."

As discussed previously (see above and pgs. 23-24 of Applicant's January 4, 2010 Response), Nippert does not disclose a partial motoring cycle and is in fact incompatible with a partial motoring cycle. The Office Action (pages 7-8) alleges that it would be obvious to one of ordinary skill that pumping a portion of the total volume and bypassing the rest when the device is operated as a pump is analogous to motoring the piston using a portion of the total volume and bypassing the rest when the device is operated as a fluid motor. However, not only does Nippert not suggest partial motoring cycles nor provide an example of a machine compatible with partial

motoring cycles, this statement illustrates the difficulties that would be faced to adapt Nippert to carry out partial motoring cycles. The Office Action has referred to "bypassing the rest", but it is not apparent how one could "bypass the rest" during motoring. See comments above in relation to claim 6. Inventive activity or hindsight knowledge of the invention of claims 25 and 44 would be required to implement a successful partial motoring stroke. It is simply not apparent or obvious from the cited art how to carry out partial motoring or why it would be of benefit.

The Office Action has referred to Salter as disclosing a partial motoring mode in column 4, line 30-31 ("partially disabled motor") and in lines 63-68 ("...close the high-pressure valve 30 part way through the power stroke...."). The first reference is to a motor in which some of the cylinders are kept running in idle modes and is not a reference to any individual cylinder being run in a partial mode.

The second reference is presumably a reference to column 3, lines 63-68 (not column 4 as implied). This is not a description of partial motoring mode controlled by operating valves as required by claims 25 and 44. It is a description of a <u>failure mode</u> in which the device acts as a low-rate damper when the shaft drives the motor. In this case, the displacement of fluid is not under the control of the controller but the high-pressure valve and low-pressure valve each close due to the effects of a pressure drop and pressure differential respectively, without any active control. Thus, Salter does not disclose a partial motoring mode obtained by <u>operating valves</u>, nor suggested that one might be achieved, nor how it might be achieved, nor what it would be useful for.

The reference in Mestieri to a motoring cycle involving control of valve timing is not relevant – the motor of Mestieri is based on a completely different process to that disclosed in Salter and it does not provide evidence as to how the process disclosed in Salter could be

modified. Specifically, the Mestieri machine uses the crank case 43 pressure to lift the piston-cylinder assemblies 18. There is no bypassing of fluid to the low pressure manifold – in fact, disabled (akin to idling) cylinders in Mestieri's machine have no fluid flow as the piston is held in the top dead centre position.

Further, the Office Action asserts (section 17) that Mestieri "provides additional evidence that a partial motoring mode can be created simply by manipulation of the controlling valves." However, the variable displacement mode referred to by Mestieri (col. 5, lines 1-5) is not a "partial mode" as meant in the present invention. Indeed Mestieri is explicit (col. 4, lines 62) that the activation of control valves 30 to disable motoring strokes should (always) be at top dead centre – an action which only affords a full motoring stroke. The operation of the variable displacement mode of Mestieri must be read from the description: "to disable or remove or introduce selected piston-cylinder assemblies 18 to suit particular speed requirements" (col. 5, lines 18-22; see also col. 1, lines 42-45). Notably, Mestieri, does not at any point even disclose a cycle by cycle selection of motoring and idling strokes to achieve a time-averaged flow rate, let alone the interspersing of full, idle and part strokes. Indeed, Mestieri teaches away from this – "especially suitable for applications requiring uniform torque" (col. 1, lines 14-16).

Finally, Mestieri does not disclose a pumping mode, and it is not possible one could be achieved with the apparatus described. A pumping mode would require the piston to descend, at BDC, from its full contracted position held by crank case pressure. Clearly opening the high pressure control valve 30 to achieve this would be catastrophic, and closing the low pressure control valve 30 would have no effect.

Thus, general statements concerning the entirely different machine Mestieri do not provide evidence in any way relevant to the invention of claims 25 and 44.

The Office Action (section 47) has alternatively argues that claims 25 and 44 are unpatentable in the light of Sturman, Nippert and Salter. However, Sturman discloses neither motoring nor partial modes. Sturman could not be adapted to control a motoring cycle as motoring cannot be regulated by simply holding a valve open in specific circumstances. Moreover, there is no mechanism to hold open the high pressure valves. Nippert discloses partial modes, but does not disclose partial motoring modes and the disclosure of Nippert is incompatible with partial motoring. As described above, Salter at al. does not disclose a partial motoring mode which can be operated by controlling valve operation but instead discloses what is effectively a failure mode arising when the shaft drives the motor, in which valves close and open outside of electronic control.

Thus, the prior art does not suggest a partial motoring mode in which the valves are controlled to use only part of the usable volume of the chamber, nor teach how such a mode might be achieved.

Accordingly, Applicant respectfully requests that the above-noted rejections under 35 U.S.C. §103 be withdrawn.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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